AIR REGISTRATION BOARD

NOTES ON THE
REGULATIONS GOVERNING THE

AIRWORTHINESS
OF
CIVIL AIRCRAFT

REGISTERED IN THE UNITED KINGDOM

REVISED IN THE LIGHT OF THE AIR NAVIGATION ORDER, 1949 AND THE AIR NAVIGATION REGULATIONS, 1949—APRIL, 1949

A.R.B. HANDBOOK No. 1

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I

GENERAL

IN October, 1919, an International Convention for the regulation of air navigation was signed in Paris.

Convention relating to the Regulation of Aerial Navigation dated 13th Oct., 1919

The purpose of the Convention was to provide a minimum standard of safety which would be acceptable to the various countries that ratified it, but the details of how the standard should be achieved were left to the individual Governments.

The Convention was ratified by the British Government by the Air Navigation Act of 1920, and it is this Act which provides *inter alia* for regulations which in general terms control the airworthiness of British aircraft.

Air Navigation Act 1920

The Air Navigation Act of 1920 provides that, by an Order in Council, the British Government may make provision as to the manner and conditions of the issue and renewal of any certificate required by the Act. The Act itself does not attempt to detail any of the requirements, and the first step towards this was taken in the Statutory Rules and Orders which were made under this Act. Similar action was taken under the Air Navigation Act of 1936 and subsequent Air Navigation Orders. The current Air Navigation Order and Air Navigation (General) Regulations dated 1949 came into operation on 1st April of that year. The former replaces and revokes the Air Navigation (Consolidation) Order 1923 and all the amending orders made thereto. The provisions contained therein have been revised and amplified to accord with current needs and to bring them into line with the Chicago Convention dated 7th December, 1944, and such of the Annexes thereto relating to standards, practices and procedures as have been adopted or recommended for adoption by the International Civil Aviation Organisation set up in accordance with the terms of the Convention.

The Air Navigation (Consolidation) Order 1923, dated 19th Dec., 1923 as amended by subsequent Orders

The Order prescribes airworthiness regulations, licensing of personnel and the regulations governing the operation of aircraft. The Order is further explained by the Air Navigation (General)

Ministry of Civil Aviation Act 1945

Regulations 1949. Amendments will be issued from time to time on the authority of the Minister of Civil Aviation.

Essential minimum standards of design and construction together with information on procedure are given in British Civil Airworthiness Requirements published by the Air Registration Board.

Where necessary, further explanations and points of detail affecting airworthiness are given in Notices to Licensed Aircraft Engineers and to Owners of Civil Aircraft which are published from time to time by the Air Registration Board.

In summary form :—

1. International Convention 1919.
2. Air Navigation Act 1920 which ratified this Convention.
3. Air Navigation Act 1936 which amended the Air Navigation Act 1920.
4. Air Navigation Order, 1949, and the Air Navigation (General) Regulations, 1949.
5. British Civil Airworthiness Requirements which lay down minimum requirements for design and construction of civil aircraft and contain particulars of procedure.
6. Notices to Licensed Aircraft Engineers and to Owners of Civil Aircraft.

The Air Navigation Act of 1936 gave powers to the Secretary of State for Air to delegate certain of his functions. These powers are now administered by the Minister of Civil Aviation. By Order he has delegated to the Air Registration Board *inter alia* the responsibility of making recommendations to him regarding the issue and renewal of Certificates of Airworthiness and licences to certain persons employed on the construction, overhaul, maintenance and operation of aircraft and all ancillary equipment. He has also delegated to the Air Registration Board the responsibility for the approval of the organization of any firm making reports on matters affecting airworthiness. Under a further delegation the Board assumes responsibility for the survey of the installation of radio stations in aircraft.

In the following pages the requirements of the Air Registration Board may, by reason of these delegations, be regarded as the requirements of the Minister of Civil Aviation.

II

REGISTRATION

APPLICATION for registration of an aircraft is only accepted by the Ministry of Civil Aviation if the owner is a British subject or a British protected person. If the application is made by a company, then the Chairman and at least two-thirds of the Directors must be British subjects or British protected persons. A.N.O. '49 Article 1-6 A.N.R. '49 Section II

An aircraft may only be registered in one country at one time. Application for registration must be made to the Secretary, Ministry of Civil Aviation, on a form which is supplied for the purpose (M.C.A. Form 1). A fee of one guinea must accompany the application form and, if the application is accepted, the Ministry of Civil Aviation will issue a Certificate of Registration. The certificate is not subject to renewal and is valid until change of ownership or until the aircraft is destroyed. In either of these events the owner should complete the appropriate section on page 3 of the certificate and forward it to the Ministry of Civil Aviation.

The Minister can refuse to enter an aircraft on the United Kingdom register and can cancel a registration if it appears to him that the aircraft could more suitably be registered in the Dominions. This applies to aircraft which are so often abroad that they would not come under the direct supervision of the Board or the Ministry.

Unregistered civil aircraft may only be flown in accordance with "A" conditions as set out on page 10 of this handbook. Alternatively special written permission may be given by the Minister.

An official list of aircraft registered in the United Kingdom is kept by the Ministry of Civil Aviation and may be consulted on request.

A card register of aircraft which is kept up to date by the issue of supplements is published by the Board. This register may be obtained in alphabetical order of registration letters, names

of owners, types of aircraft or dates of renewal of C. of A. Each card contains particulars such as Constructors' Name, Type of Engine(s) fitted, C. of A. issue and expiry dates, all-up-weight and so on. Particulars of radio apparatus installed is given on the reverse of each card. Information as to the subscription and conditions of publication can be obtained on application to the Secretary.

III

THE IDENTIFICATION AND MARKINGS APPLICABLE TO UNITED KINGDOM REGISTERED AIRCRAFT

REGISTERED MARKINGS.

A.N.O. '49 Article 7-9 & Schedule I

THE national mark of United Kingdom registered aircraft is the letter "G" in Roman character, and the registration mark is a group of four letters also in Roman characters. The letters must be displayed to the best possible advantage, taking into consideration the constructional features of the aircraft. The marks must always be kept clean and visible.

The letter "G" and the group of registration letters must be separated by a hyphen. They must be painted (without ornamentation) as indicated hereunder :

Wings : Once only on both upper and lower surfaces of the wing structure either right across the whole of the surface or on the right half of the upper surface and the left half of the lower surface, with the tops of the letters towards the leading edges of the mainplane. The height of the letters must be at least 20 inches.

Fuselage or Vertical Tail Surface : On either side of the fuselage or hull between the mainplanes and tail surfaces, or on the upper halves of the vertical tail surfaces. When located on a single vertical tail surface they must appear on both sides and on the outboard sides only where there is more than one vertical tail surface. The height of the letters must be at 12 least ~~20~~ inches.

The letters must be solid and of uniform colour contrasting clearly with the background on which they are placed.

The width of such letters and the length of the hyphen must be two-thirds of the height of the letters and the thickness of the lines forming the letters and the hyphen must be one-sixth of the height of the letters. The letters constituting groups of markings must be of equal height and they must be separated from each other by a space equal to half the width of a letter.

The new markings will apply to aircraft registered after 1st April, 1949; however, aircraft already registered can carry existing markings until the end of 1950, after which they must conform to the latest requirements.

When constructional features of the aircraft do not permit compliance with the above, the markings may be affixed to the aircraft in a manner approved by the Minister.

OWNER'S NAMEPLATE.

All registered aircraft must have a metal nameplate fixed near the main entrance of the aircraft, upon which is stamped or engraved the registration marks and the registered owner's name and address. This metal plate must be fireproof so that there will be a means of identification in the event of the aircraft being destroyed by fire. The Board recommends the use of a stainless steel plate.

IV

CLASSIFICATION

A UNITED KINGDOM Certificate of Airworthiness may be issued to any aircraft registered in Great Britain and Northern Ireland provided that its design, construction and equipment meet the prescribed conditions. A.N.O. '49 Article 11 A.N.R. '49 Section III

Every aircraft for which a Certificate of Airworthiness is granted will be classified as belonging to one or more of the following categories and subdivisions:— B.C.A.R

1. *"Normal" Category.*

Subdivision (a) Public transport for passengers.
" (b) Public transport for mails.
" (c) Public transport for goods.
" (d) Private.
" (e) Aerial work.
" (h) Demonstration.
" (i) Crew familiarization.

2. "*Semi-aerobatic*" *Category.*

Subdivision (a) Public transport for passengers.
" (b) Public transport for mails.
" (c) Public transport for goods.
" (d) Private.
" (e) Aerial work.
" (h) Demonstration.
" (i) Crew familiarization.

3. "*Aerobatic*" *Category.*

Subdivision (a) Public transport for passengers.
" (b) Public transport for mails.
" (c) Public transport for goods.
" (d) Private.
" (e) Aerial work.
" (h) Demonstration.
" (i) Crew familiarization.

4. "*Special*" *Category.*

Subdivision (f) Racing or record.
" (g) Research or experimental.
" (h) Demonstration.
" (i) Crew familiarization.

The category in which an aircraft will be granted a certificate of airworthiness is mainly dependent upon its design and construction; these categories may be defined as follows:

1. *Normal Category.* Operations are limited to normal flying manoeuvres. Aerobatic manoeuvres are not permitted.

2. *Semi-Aerobatic Category.* Operations are limited to normal flying manoeuvres and certain aerobatic manoeuvres as detailed on the certificate of airworthiness. Aerobatic manoeuvres not so mentioned are not permitted.

3. *Aerobatic Category.* Normal flying and full aerobatic manoeuvres are permitted. Unorthodox aerobatic manoeuvres such as bunts, etc., are not permitted.

4. *Special Category.* Operations are limited to particular flights for particular purposes as detailed on the certificate of airworthiness.

Note: The period of validity of the certificate in the Special Category may, according to the circumstances of the case, be less than the usual 12 months.

DEFINITIONS OF SUBDIVISIONS.

(a) (b) (c) The words "Public Transport" mean in this connection that the aircraft may be used for carrying passengers, mails or goods, respectively, for hire or reward. The restrictions of these subdivisions are applicable where the carriage is effected by an air transport undertaking whether for hire or reward or not.

(d) "Private Aircraft" are those used for purposes other than those specified above, and this category usually covers an aircraft operated by the private owner who may carry passengers but does not accept payment.

(e) "Aerial Work" aircraft are those used for any commercial or industrial purpose or for hire or reward purposes other than the carriage of passengers, mails or goods, as specified above. Examples are aircraft used for aerial photography, aerial survey work or crop spraying. These aircraft will probably incorporate special structural features or equipment.

(f) "Racing or Record" aircraft are those which are used exclusively for sporting or technical purposes.

(g) "Research or Experimental" aircraft are used exclusively for experimental flight. In practice they operate under a special form of permit issued by the Minister of Civil Aviation, which is described in detail later.

(h) "Demonstration." Permits the aircraft to be used for demonstration in flight during which non-fare-paying passengers may be carried unless such carriage is prohibited by the certificate of airworthiness.

(i) "Crew Familiarization." Permits the aircraft to be used to familiarize crews in the operation of the aircraft.

General. An aircraft classified in more than one subdivision may be employed during the same flight for purposes appropriate to more than one of those subdivisions, but in every such case the requirements of the subdivision demanding the highest standard shall be satisfied. When, however, such an aircraft is used for purposes appropriate to only one of those subdivisions, the requirements of that subdivision only need be satisfied.

Aircraft classified in subdivision (e), (f), (g), (h) or (i) may, according to their design or equipment, be limited by the conditions of the certificate of airworthiness to use for specific purposes.

Note : Aircraft used for flying instruction for which payment is made must hold a Certificate of Airworthiness in subdivision (a).

A.N.O. '49
Articles 2 and 10

A.N.R. '49

Aircraft may, under certain conditions and with the prior permission of the Minister, fly without a certificate of airworthiness. In such cases they must comply with either the "A" or "B" Conditions set out hereunder :—

"*A*" *Conditions.*

(i) An application for the issue or renewal of a certificate of airworthiness in respect of the aircraft or of a validation of such a certificate or an application for the approval or modifications shall have been made prior to the flight.

(ii) The aircraft shall be either a series aircraft or an aircraft in respect of which a certificate of airworthiness or a validation of such a certificate has already been issued under the provisions of the Order.

(iii) The flight shall be carried out only for the purpose of either qualifying for the issue or renewal of a certificate of airworthiness or a validation of such a certificate or obtaining the approval of modifications.

(iv) The flight shall take place wholly within ten nautical miles of the place of departure which shall be a licensed aerodrome, a Government aerodrome or an aerodrome used in connection with an aircraft factory.

(v) The aircraft shall not fly over any town or populous area, over any assembly of persons in the open air, or over any aerodrome where at the time conditions are such as to make the flying of the aircraft dangerous.

(vi) The flight shall not have been forbidden by the Minister.

"*B*" *Conditions.*

(i) The flight shall be carried out under the control of a person or firm approved in writing for the purpose of these "B" Conditions and subject to any conditions or limitations attached to such approval.

(ii) The flight shall be carried out only for the purpose of qualifying for the issue or renewal of a certificate of airworthiness or of a validation of such certificate, or for the purpose of obtaining the approval of modifications, or for the purpose of or in connection with any other experiment or test.

(iii) The aircraft shall, if registered, be marked in accordance with the provisions of Article 8 of the Order, and, if unregistered, be marked in a manner approved for the purpose of these "B" Conditions.

(iv) The aircraft shall not fly over any town or populous area, over any assembly of persons in the open air, or over any aerodrome where at the time conditions are such as to make the flying of the aircraft dangerous.

V

THE CERTIFICATE OF AIRWORTHINESS

THE United Kingdom Certificate of Airworthiness must be carried by *all* aircraft engaged on international navigation, and all public transport or aerial work aircraft whether engaged on international navigation or not. A.N.O. '49 A.N.R. '49 B.C.A.R.

There are three variations of the certificate, as follows :—

(i) Flying machines .. .. .. M.C.A. Form 956
(ii) Gliders .. .. M.C.A. Form 957
(iii) Prototype flying machines issued with a certificate of airworthiness after 1st January, 1949, and Series flying machines to such prototypes .. .. .. M.C.A. Form 958

A Flight Manual will be issued to aircraft in division (iii) above to be used in conjunction with the certificate of airworthiness. This Flight Manual must contain, in a clear and concise manner, such information as will assist the crew to familiarize themselves with the operational details of the aircraft including performance information, operating limitations and such additional descriptions, definitions and information as may be required by the Board.

Certificates of airworthiness current on 1st April, 1949, will eventually be replaced by the new M.C.A. Form 956.

M.C.A. FORM 956

Page 1 of the certificate carries a profile photograph of the aircraft, "quarter plate" $4\frac{1}{4}$ in. x $3\frac{1}{4}$ in. in size. The photograph may be of the actual aircraft concerned or one of a similar type. The certificate has a serial number and each clause or item is numbered. Page 1 contains items 1 to 23 which detail the owner, constructor, type, classification, the maximum number of persons to be carried, certain over-all dimensions of the aircraft, the international power and revolutions of the engine

or engines, and the fuel and oil consumptions (where applicable).

On page 2, item 24 details particulars of the approved propellers, and in some cases, the alternative types of propellers which may be fitted. Items 25 to 32 state the empty weight of the aircraft, the weights of fuel and oil carried, weight of crew, weight of equipment and radio apparatus, the maximum commercial load and the maximum total weight authorized.

The remainder of page 2 contains the Compulsory Conditions commencing at item 33. These conditions define the maximum weights for flight and landing and the centre of gravity range permitted. The limitations on the engine performance and the speed of the aircraft in various conditions are also given.

Any further compulsory conditions which may be necessary to define, for example, certain special loading requirements, will be given on page 3.

Page 3 also indicates the date of issue of the certificate.

Page 4 is reserved for details of overhauls for renewal and extension of the certificate, and on this page is entered the date of expiry of its validity and any periods of suspension.

M.C.A. Form 957

This certificate which has substantially the same lay-out as M.C.A. Form 956, is used for Gliders.

M.C.A. Form 958

This certificate contains no technical information as this is transferred to the Flight Manual. Included are particulars of owner and aircraft registration, official clauses defining the status of the certificate and flight manual, also period of validity.

VI

APPLICATION FOR A CERTIFICATE OF AIRWORTHINESS

A.N.O. '49
Article 11
A.N.R. '49
Section III

B.C.A.R.

Formal application for the issue of a Certificate of Airworthiness is first made on forms (M.C.A. Forms 3 and 3A) obtainable from the Ministry of Civil Aviation. The forms provide for the name, address and nationality of the owner, the name of the constructor, the registration marks, a brief description of the aircraft and the approximate empty weight and classification (see page 7).

The applicant is requested to state whether the aircraft is of new design, or if it conforms in all respects to one for which a certificate of airworthiness has already been issued. From the answer to this question it is possible to judge whether the aircraft is a "Prototype" aircraft or a "Series" aircraft.

A "Prototype" aircraft is a newly constructed aircraft, the design of which, in part or in whole, has not previously been investigated by the Board.

A "Series" aircraft is an aircraft, the design of which is similar in every respect to that of one for which a certificate of airworthiness has already been issued by the Minister of Civil Aviation.

The application form M.C.A. 3 should be completed and forwarded to the Ministry of Civil Aviation. M.C.A. Form 3A should, at the same time, be forwarded to the Board with the appropriate fee for the issue of a certificate of airworthiness. A list of fees is given at the end of this handbook.

The Board may, at its discretion, reduce the prototype fee if it has previously investigated a substantial part of the design of an aircraft, but the actual fee will be dependent upon the amount of work involved.

The Board cannot undertake any investigation of an aircraft until an application and a fee or deposit are lodged.

VII

THE ISSUE OF A CERTIFICATE OF AIRWORTHINESS FOR A "PROTOTYPE" AIRCRAFT

THE terms of the Air Navigation Order 1949 require that the Minister of Civil Aviation should be satisfied on various points, namely that :— A.N.O. '49 Article 11

B.C.A.R.

(a) The design has been approved by the Board in regard to safety.
(b) The construction has been approved by the Board in regard to workmanship and material used.
(c) The aircraft is fitted with the prescribed instruments and equipment.

(d) A satisfactory demonstration in accordance with the requirements of the Board has been made in flying trials to ensure that the aircraft is safe for the purpose for which it is intended.

(e) The aircraft has been weighed and weight schedules prepared in accordance with British Civil Airworthiness Requirements and Air Navigation Regulations, Section IV (see Chapter XV).

(f) The engine or engines fitted are of an approved type.

DESIGN.

There are two methods of obtaining approval of the design of an aircraft. These are dealt with in British Civil Airworthiness Requirements and are further explained in A.R.B. Handbook No. 3.

One of the methods is related to a firm which, by employing exclusively its own approved design organisation, is regarded as "an approved firm." The other is related to "an unapproved firm" which operates in conjunction with approved consultants.

When an individual or firm decides to design and construct an aircraft for which a certificate of airworthiness is desired, the first step would be the submission of a formal application for the issue of a Certificate of Airworthiness as detailed in Chapter VI of this handbook (page 12).

The applicant would then be required to submit to the Air Registration Board such particulars as are necessary for the Board to form an opinion as to the safety of the aircraft from the point of view of design.

If the design incorporates unusual features then the Board may require further evidence to show that the aircraft complies with required standards.

The particulars submitted must include general arrangement drawings of the proposed aircraft and in the case of both the approved and unapproved design organizations, the Board requires that the complete design and strength calculations, together with any tests as mentioned in (7) below, shall have been made before the construction of the aircraft is very far advanced.

The procedure is that all design data, calculations, reports on tests and drawings of the "Prototype" aircraft

(a) shall be in accordance with British Civil Airworthiness Requirements, and

(b) shall be held at the disposal of the Board.

In every case design organizations will be required to produce a Type Record. This Type Record is a summary of the type design to the date when the aircraft is ready for its flight trials. Any modifications made to the design at a later stage must be covered by an addendum to the Type Record and the modifications must be approved by the Board.

This record includes the following information :—

(1) A general arrangement drawing of the aircraft.
(2) A complete list of all the drawings.
(3) A summary of the basic aerodynamic and other data used in the design.
(4) Maximum weights and extreme centre of gravity positions permissible.
(5) A summary of the design calculations.
(6) A list of the strength factors of the main parts.
(7) Copies of mechanical test reports, wind tunnel test reports, etc.
(8) Report on all the flying trials carried out.
(9) Particulars of any variations from British Civil Airworthiness Requirements.

In the case of an unapproved organization designing an aircraft the Board will require that the drawings and calculations be submitted through a firm or consultant who is already acquainted with the requirements and the standard methods of calculations employed.

Under certain conditions an unapproved firm working in conjunction with an approved consultant might be considered by the Board as an approved organization.

CONSTRUCTION.

The principles governing "approved" and "unapproved" firms outlined for the *design* of the "Prototype" aircraft apply also to its *construction.* The inspection during construction should not be carried out by an organization which has had no previous experience of such work. If such a course were adopted the Board would find it necessary to station its surveyors at the constructor's works to carry out a continuous check on organ-

ization, construction and inspection. An arrangement of this kind would be cumbersome and costly even if the Board could undertake the work, and whether design organizations were approved or not, the Board would probably require that the inspection organization responsible for its construction be approved.

Accordingly, the constructor, if not already approved, would be well advised to obtain the services (part or full time) of an aircraft engineer suitably licensed in Category "B" who would be able to put the organization on a basis suitable for the Board's approval in the appropriate category (see A.R.B. Handbook No. 3).

In the case of an approved firm, duplicate checks and inspections by the Board's surveyors are reduced to a minimum, which means in practice that only occasional checks by them of the organization and a final inspection of each main component are required.

In such an approved inspection organization, the Chief Inspector would be responsible for ensuring that :—

(a) All materials used in the construction of the aircraft are in accordance with the specifications approved by the Board for the type design and by suitable examination, sampling and testing by approved methods, that every batch of such material complies with such specification.

(b) Every detail and part of the aircraft has been examined by the constructor's inspection staff to the relevant approved detail drawings and that they conform to the approved type design.

(c) The constructor's inspection staff stamps, or other means of identification provides means for the marking of each detail part approved by them in such a way that the individual responsible for such approval can subsequently be identified.

(d) An efficient progress inspection during the work of assembly is maintained and records of the progress of such inspection for each component are made and that the inspection record is signed by the inspector responsible.

(e) Operations such as heat treatment of metals, seasoning and conversion of timber, glueing, doping, etc., are carried out by approved methods, and

(f) All main components and assemblies of the aircraft are given a constructor's serial number and that this serial

number is displayed in a prominent position on the completed component or assembly, and that detail parts of the structure are stamped to show the drawing or part number from which it has been made.

Note : With reference to (f) it is usual to use metal stamps for metallic parts and rubber stamps for non-metallic parts. In certain cases, such as control cables, it may be necessary to affix metal tabs and in the case of hardened steel parts which cannot be stamped, etching may be used.

Certain components such as propellers, radiators and tanks, must show a drawing number and a serial number, and tanks must be marked to indicate their capacity and whether they are for petrol, oil or water.

Every component and detail part must carry a constructor's inspection stamp of a type that will ensure the identification of the person responsible for the inspection, the only exceptions being very fragile parts or minor parts such as split or taper pins. Metal inspection stamps for the stamping of metal parts must be provided with a border of circular or oval shape. Triangular or square borders are not permitted as the corners may induce fatigue failure.

Evidence of heat treatment by normalising of a metal fitting is indicated by the letter "N" surrounded by a circular border.

The Chief Inspector must ensure that all components and parts obtained from sub-contractors have been inspected and approved in accordance with the above conditions. He must also be satisfied that the instruments and equipment fitted to the aircraft have been manufactured under approved conditions and that they comply with specifications approved by the Board.

The engine or engines installed must be of a type previously approved for use in civil aircraft.

During the construction of the aircraft the Board will from time to time indicate to the Chief Inspector when it considers it necessary for its surveyors to duplicate the firm's inspection of components and assemblies. Normally a surveyor will carry out a final inspection of each main component.

If necessary, the Chief Inspector may make application to the Board for a "Concession" to use a limited quantity of material or a limited quantity of details or parts which have been incorrectly manufactured but are not unserviceable. Suitable record of such concessions must be kept by the Chief Inspector and be readily available to the Board's surveyor.

The Chief Inspector should keep in close touch with the representatives of the Board in connection with the inspection requirements that are particularly applicable to "Prototype" aircraft.

Before the official flight trials are carried out the aircraft

must be weighed and the centre of gravity determined (for details see page 33 of this Handbook), and these operations will be carried out in the presence of the Board's surveyor.

On completion of all inspection operations, the aircraft will be submitted to the Board for final inspection and the firm's Chief Inspector will supply the Board with a summary of the inspection record of the aircraft. For this purpose A.R.B. Form 268 (copies of which can be obtained on application to the Board) is used. All the particulars required by the form must be given. Three profile photographs (size $4\frac{1}{4}$ in. x $3\frac{1}{4}$ in., i.e., quarter plate) of the aircraft, a weight schedule and a report of the determination of the centre of gravity must accompany this form. A Service and Instruction Manual and Flight Manual must be prepared in accordance with British Civil Airworthiness Requirements.

Prototype aircraft and aircraft incorporating modifications not previously approved for the type concerned must be flight tested in accordance with flight test schedules agreed with the Board. Adequate notice of the test should be given, together with relevant performance estimates and descriptive details as prescribed in British Civil Airworthiness Requirements.

When the Board is satisfied that all the conditions and requirements have been complied with, the necessary recommendation is made to the Minister of Civil Aviation that a Certificate of Airworthiness should be issued.

VIII

THE ISSUE OF A CERTIFICATE OF AIRWORTHINESS FOR A "SERIES" AIRCRAFT

THE inspection during construction of a "Series" aircraft is normally carried out by a firm holding Air Registration Board approval, and the inspection of such aircraft, including the items carried out by the Board in the case of the "Prototype" aircraft, is undertaken by the constructor's inspection staff.

The Board must be satisfied that the firm's inspection staff is competent to ensure that aircraft passed by it conform in all essential respects to the "Prototype" aircraft. A periodical

supervision of the constructor's inspection organization will be carried out by the Board's surveyors, and they may at their discretion inspect a "Series" aircraft at any time during its construction.

On completion of the construction of a "Series" aircraft, a final inspection is made and a certificate of fitness for flight is given by a representative or representatives of the constructor holding engineers' licences in Categories "A" and "C" covering the particular types of airframe and engine.

On completion of the whole of the inspection operations, the firm should supply the Board with the following documents :—

(1) Certificate of Particulars for the issue of a Certificate of Airworthiness (A.R.B. Form 252) in duplicate (A.R.B. Form 252A for Gliders);

(2) Weight Schedule, and

(3) Three profile photographs of the aircraft (size $4\frac{1}{4}$ in. x $3\frac{1}{4}$ in. —quarter plate).

On completion of the aircraft and of the applicant's flying trials, the firm should supply the Board with a completed copy of A.R.B. Form 268 (Civil Aircraft Inspection Record).

All particulars, most of which are self-explanatory, required by Form 268 must be given. The application number on page 1 may be obtained from the Board. Details of the test flight carried out by the constructor's approved test pilot are entered on page 12, and page 13 is the certificate of fitness for flight completed by the licensed engineers as mentioned above.

Page 15 is a certification which is signed by the constructor's Chief Inspector or his deputy, that this "Series" aircraft conforms in all essential respects to the "Prototype" aircraft. If the aircraft is different from the "Prototype" aircraft in that it embodies certain approved modifications, then the inspector is required to detail these modifications on page 14 of the form.

The Certificate of Particulars provides the information required for the Certificate of Airworthiness which will eventually be issued.

This certification is normally signed by a surveyor to the Board.

The weight schedule must be in accordance with the requirements of the Air Navigation Regulations (see page 34), and instructions regarding the supply of Service and Instruction and Flight Manuals must have been complied with.

On receipt of the completed documents, the Board will recommend the Minister of Civil Aviation to issue a Certificate of Airworthiness for the particular aircraft.

When desired by the constructor, and in the case of "Series" aircraft only, a temporary "Short Term" Certificate of Airworthiness, valid for a period of two months, will be issued when the Board makes its recommendation to the Minister of Civil Aviation. This serves to cover the period before the issue of a certificate valid for twelve months.

IX

THE VALIDATION OF FOREIGN CERTIFICATES OF AIRWORTHINESS HELD BY UNITED KINGDOM REGISTERED AIRCRAFT

A.N.O. '49 Article 11 and 25

A.N.R. '49 Section III

B.C.A.R.

VALIDATION of certificates of airworthiness is confined to those certificates issued in respect of aircraft registered but not manufactured in the United Kingdom.

This means that an aircraft constructed abroad which holds a Certificate of Airworthiness of the country of origin *may* have such certificate validated in this country providing that it complies with certain conditions.

The validation certificate (M.C.A. Form 959) is issued by the Minister of Civil Aviation on the recommendation of the Board when it is satisfied as to the general condition of the aircraft. The grant of a validation certificate does not necessarily mean that the aircraft complies with the requirements for the issue of a United Kingdom Certificate of Airworthiness. The validation certificate permits the aircraft to operate as if it held a United Kingdom certificate, but may impose specified limitations and conditions.

The validation certificate is attached to the Certificate of Airworthiness of the country of origin and must be carried on the aircraft for international navigation, public transport flying and aerial work. It is subject to the conditions of renewal of United Kingdom Certificates of Airworthiness. However, the Minister may, after being furnished with evidence, issue a new

certificate of airworthiness instead of renewing the validation.

It is a condition of issue that a Service and Instruction Manual must be produced for the Board's inspection. Should such a Manual not be available arrangements must be made for its publication in accordance with British Civil Airworthiness Requirements.

X

THE ISSUE OF A CERTIFICATE OF AIRWORTHINESS FOR A GOVERNMENT SURPLUS AIRCRAFT

IF the owner of a second-hand "Service" aircraft desires to obtain a Certificate of Airworthiness for the aircraft he must register the aircraft and then make application for the issue of a Certificate of Airworthiness, as outlined in Chapter VI of this Handbook.

If the particular type of aircraft has never held a Certificate of Airworthiness, the Board may require "Prototype" procedure to be followed as described on page 13 of this Handbook, but the normal procedure is that the Board accepts the "Type Record" submitted for "Service" aircraft.

The procedure adopted is generally that which is followed for the renewal of a certificate of airworthiness but, in addition, the Board must be satisfied that the aircraft conforms to civil requirements and that the instruments and equipment are as prescribed by the Air Navigation Regulations.

XI

THE VALIDITY AND RENEWAL OF A CERTIFICATE OF AIRWORTHINESS

A CERTIFICATE of Airworthiness is usually valid for a period of twelve months, the period being inclusive of the issue and expiry dates. A.N.O. '49 Article 11

The aircraft owner or his representative may at any time apply for the renewal of a Certificate of Airworthiness. If the certificate has expired the aircraft may not be flown except for the A.N.R. '49 Section III B.C.A.R.

purpose of qualifying for the renewal of the certificate, unless written permission has been granted by the Minister of Civil Aviation.

The Air Navigation Order authorizes the Minister of Civil Aviation or his authorized representatives to limit or extend the period of validity of a Certificate of Airworthiness. He may at his discretion give instructions for the inspection, overhaul, and repair of any aircraft having a valid Certificate of Airworthiness, and he may cancel or suspend the Certificate of Airworthiness of any aircraft deemed to be unsafe after such inspection.

Renewal of Certificate of Airworthiness.

Application for the renewal of a Certificate of Airworthiness should be made on M.C.A. Forms 79 and 79A to the Ministry of Civil Aviation and the Board respectively at least one month before the date from which the renewal is required, in order that necessary arrangements may be made for the inspection of the aircraft. The application to the Board should be accompanied by the appropriate fee in accordance with the scale which is given on page 43.

Upon receipt of the application, arrangements are made for a surveyor to the Board to inspect the aircraft.

The applicant's approved inspection organization or engineer responsible for the overhaul should submit the aircraft in a clean condition, suitably trestled and with all cowlings, inspection panels, etc., removed or opened, so that complete access to the interior and exterior of the aircraft and its controls is provided.

Any further dismantling at this stage is at the discretion of the Board's surveyor but in any case no major overhaul or repair should be embarked upon before a preliminary inspection by him has been made.

Airframe, engine and propeller log books must be produced for examination with entries complete and up to date. The Certificate of Airworthiness must be handed to the surveyor or forwarded to the Board with the application for renewal.

The Board's surveyor will decide the extent of overhaul and repair work to be carried out and a suitable inspection report in duplicate will be signed by him and the engineer in charge. The report will normally be made by the engineer and amended by the Board's surveyor as necessary. The inspection report should be divided into component or assembly headings and

under each sub-heading should be shown the component serial number and details of the overhaul work to be carried out on it. Unless otherwise agreed, components such as tanks, instruments, generators, etc., will automatically be reconditioned and tested.

Upon completion of the overhaul, the Surveyor in Charge of the local office of the Board should be advised that the aircraft is ready for final inspection.

The engineer must prepare a log book entry covering all the work carried out and must sign it as required by the Air Navigation Regulations. In addition, the following certification should be made at the foot of the entry and signed by the engineer immediately responsible for the overhaul :—

> "I hereby certify that all recommendations made by the Air Registration Board in respect of the overhaul of this aircraft for renewal of its Certificate of Airworthiness have been satisfactorily carried out."

The engineer must supply the surveyor with reports of petrol flow checks, electrical tests and any other such reports as the Board may require. The surveyor will indicate whether or not he wishes to conduct these tests personally. The surveyor will also decide whether the aircraft is to be re-weighed.

The surveyor will then carry out a final inspection of the aircraft and, if he is satisfied, the aircraft may be flight tested.

On completion of a satisfactory test flight and all the formalities described above, the surveyor will hand to the owner or his representative a Short Term Certificate of Airworthiness which will normally be valid for a period of two months. This certificate covers the interim period during which the original certificate is endorsed (normally for a period of twelve months from the date of issue of the Short Term Certificate).

Royal Aero Club Maintenance Scheme.

A maintenance scheme for bonafide privately owned aircraft, up to an all up weight of 3,500 lb., is operated under the direction of the Royal Aero Club.

Organizations wishing to operate this scheme should in the first instance apply to the Board who will make recommendation that the firm's name should be placed on the official list.

The schedule used for this scheme comprises the following inspectional sequence :—

(i) Monthly inspection.

(ii) 6 monthly or 120 hour, whichever occurs first.

(iii) 12 monthly, to coincide with the certificate of airworthiness renewal.

(iv) 3 yearly or 500 hour, whichever occurs first.

Engine and accessories will be overhauled in accordance with maker's instructions.

The "Continuous Overhaul" for Renewal of a Certificate of Airworthiness.

During recent years it has been found undesirable to render large aircraft unserviceable for long periods for the purpose of carrying out overhauls for renewal of Certificates of Airworthiness, and in suitable cases where a number of aircraft of a particular type are operated, a continuous overhaul system is permitted by the Board.

Past experience has shown that the continuous overhaul method is most satisfactory when an aircraft is available at its base for periods of several days in each month.

During these periods at the base, certain main components, assemblies or systems are selected for overhaul and an inspection is carried out by the Board's local surveyor. Carefully compiled records of these overhauls are maintained and if, at the end of twelve months, these show that every part of the aircraft has been overhauled to the requirements of the Board, then, after certain determinations have been made which will include re-weighing, petrol flow tests and flight trials, the Board will recommend the renewal of the Certificate of Airworthiness.

The introduction of Maintenance Schedules will have a considerable effect on the future of the yearly certificate of airworthiness overhaul, particularly in the case of hire and reward aircraft. Overhaul in relation to "flying hours" is, in many cases, superseding the "annual overhaul" which, as aircraft become larger and more complex, will die out.

As a result of a greater anticipated rate of utilization it is logical to assume that a component "life scheme" will be evolved. This would obviate lengthy periods on the ground as, within reason, time expired components may be changed during routine maintenance periods. Such components would then be completely overhauled and stored pending fitment.

XII

MODIFICATIONS TO AIRCRAFT

"Major" Modifications.

Modifications which, in the opinion of the Board, may affect the safety of an aircraft are termed "Major" modifications. When such modifications are embodied, the particular aircraft may not fly, except for test purposes, until the modifications are approved by the Board. A.N.O. '49 Article 13 A.N.R. '49 Section VII B.C.A.R.

An aircraft to which a Certificate of Airworthiness has been issued but in which major modifications are incorporated is termed a "Prototype (Modified)" aircraft.*

Application must be made to the Board for the approval of such modifications, and the procedure followed is similar to that for the approval of design and inspection for "Prototype" aircraft. The Board may, however, dispense with official flight trials or other part of the normal procedure considered unnecessary or inapplicable in a particular case. No investigation will be undertaken until the application and a deposit are lodged. Fees are calculated as indicated in Schedule IV(9) of the Order.

The fee for approval of a "major" modification is assessed by the Board and is dependent on the design investigation and the inspection that the particular modification demands.

Following written approval, modifications which have been previously investigated may be incorporated in other aircraft of the same type, subject to compliance with British Civil Airworthiness Requirements.

If the Board considers that a modification to a particular type of aircraft is necessary for safety, it may require such modification to be carried out as a condition of the validity of the Certificate of Airworthiness.

"Minor" Modifications.

A modification which, in the opinion of the Board, does not

*An aircraft to which a Certificate of Airworthiness has *not* been issued and which has had "major" modifications incorporated, is termed a "Prototype (Reduced Fee)" aircraft. (See page 13.)

affect the safety of an aircraft is termed a "minor" modification but, although "minor", it requires formal approval.

The procedure involves decision by the Board on whether a modification is properly to be regarded as "major" or "minor." This decision is based on the following considerations.

A "minor" modification is one which a surveyor to the Board decides, on the basis of his knowledge and experience and without recourse to calculations, test or other design investigation, does not reduce safety.

"Minor" modifications are, broadly speaking, of three types. The first is the relatively unimportant modification which may be approved by a licensed engineer. (This is recorded by him in the appropriate log book.) The second is the rather more important modification which the licensed engineer thinks might conceivably affect safety. He refers the matter to the nearest Board's surveyor who may decide that it is to be treated as a "minor" modification. In this event, the surveyor will issue to the applicant for the approval of the modification a statement (A.R.B. Form 261) defining the modification, giving the registration marks and type of the aircraft to which it applies, referring to any relevant drawings and stating that the modification is deemed to be a "minor" modification. The licensed engineer concerned will, on the basis of this statement, make a suitable entry in the appropriate log book and sign it.

The third is one in which the surveyor is doubtful whether the modification can be cleared as a "minor" modification and he will refer the matter to the Board's Chief Technical Officer. Should the latter deem the modification to be a "major" one, he will instruct the surveyor to inform the applicant that he must make formal application for approval under "major" modification procedure. If, on the other hand, the Chief Technical Officer decides that it can be treated as a "minor" modification, he will issue a statement, of the kind described above, to the applicant through the surveyor concerned. The surveyor will hand a copy to the licensed engineer who will, on the basis of this statement, make a suitable entry in the appropriate log book and sign it.

In the case of any modification which has been defined as a "minor" modification by the surveyor or the Chief Technical Officer, the surveyor concerned will use his discretion whether to inspect the modification himself or to leave this to the licensed engineer.

"Minor" modification action may sometimes start in a different way. The owner or constructor may make application to the Board for approval of a "major" modification in accordance with the requirements of the Air Navigation Regulations. The Board may decide, after investigation, that the modification may be treated under "minor" modification procedure. In this case, the Board will issue a "minor" modification report (A.R.B. Form 261) and will send a copy of this to the applicant. Any fees paid will be returned to the applicant.

It is not always essential that the "minor" modification should be inspected by the Board, but it is necessary for a suitably licensed engineer to check that the modification made to the aircraft is, in fact, the modification which has been certified in the "minor" modification report.

Notes : "Minor" modification procedure deals only with modifications which are certified as *not* affecting safety. This "minor" modification procedure has been introduced by the Board to put this certification on a proper basis without charge to the applicant.

The functions of licensed engineers in connection with "minor" modification procedure may also be performed by the authorized representative of a firm or company approved by the Board. (See A.R.B. Handbook No. 3.)

Certification in the appropriate log book is subject to the provisos of A.N.R. '49, Sec. VII.

Modifications which have been approved on one aircraft may be incorporated in other aircraft of the same type provided that the materials and construction conform to the original modification and that the work is certified by a licensed engineer or by the authorized representative of an "approved" firm.

XIII

THE FITTING OF GOVERNMENT SURPLUS SPARES, INSTRUMENTS AND EQUIPMENT

Notice to Licensed Aircraft Engineers No. 16

AN owner or operator of civil aircraft may desire to use new or second-hand components or spare parts which have been purchased as Government surplus. In this event, the Board requires the undermentioned procedure to be adopted ; failure

to do so will invalidate the Certificate of Airworthiness of the aircraft to which such items are fitted.

(a) The Board must be satisfied that the component has been manufactured by the aircraft constructor or his authorized sub-contractor.

(b) The component or spare part must be identified by the constructor's serial number and/or drawing number.

(c) The component or spare part must be inspected and certified by a suitably licensed engineer or approved firm, and

(d) Full details of the origin and fitting to the aircraft must be entered in the relevant log book and certified by a licensed engineer or an approved firm.

XIV

INSTRUMENTS AND EQUIPMENT TO BE CARRIED BY UNITED KINGDOM REGISTERED AIRCRAFT

A.N.O. '49 Article 30

A.N.R. '49 Section V

B.C.A.R.

THE instruments and equipment that must be carried and maintained in working order by every British aircraft registered in the United Kingdom when flying, vary with the particular flight to be undertaken and whether it is undertaken in a private capacity or for public transport.

A Certificate of Airworthiness will not be issued or renewed and licensed engineers must not sign Certificates of Safety unless certain prescribed instruments and equipment are fitted to the aircraft.

The licensed aircraft engineer is responsible for seeing that the essential instruments and equipment, and their installations, are in a serviceable condition.

The details of essential instruments and equipment are laid down in the Air Navigation Regulations, but for easy reference a summary of the requirements is given :—

ALL FLYING MACHINES.

For all flights :—

(i) Instruments and equipment, including markings and placards (as prescribed in British Civil Airworthiness

Requirements), required for the issue of a Certificate of Airworthiness for the particular aircraft :—

Airspeed Indicator.
Altimeter.
Compass (magnetic or equivalent).
Tachometer.
Oil pressure indicator.
Manifold pressure indicator (where necessary).
Oil inlet temperature indicator.
Oil tank contents indicator.
Fuel pressure indicator (for pressure system).
Fuel tank contents indicator.
Coolant temperature indicator (liquid cooled engines).
Portable fire extinguisher for pilot.
Indicators ; e.g. hydraulic pressure, vacuum, air pressure, required for such systems as are installed in the aircraft.
Safety belts for all occupants.

(ii) If radio communication apparatus is not carried, equipment for making pyrotechnical signals.

(iii) Maps or charts to cover route of proposed flight, and alternatives.

(iv) First aid kit.

(v) Such other instruments or equipment as the Air Registration Board may require to be carried.

For flights by night :—

(i) Navigation lights.

(ii) Equipment for making visual signals.

(iii) Electrical illumination for instruments and equipment.

(iv) Turn and bank indicator.

(v) Gyroscopic bank and pitch indicator.

(vi) Gyroscopic direction indicator.

Flights involving aerobatic manoeuvres :—

(i) Safety harness for every seat in use.

Flying boats and amphibians :—

(i) Equipment for making sound signals.

(ii) Equipment for displaying mooring and towing lights.

(iii) Landing wheel position indicators (for amphibians only).

Flights under Instrument Flight Rules :—

(i) Turn and bank indicator.
(ii) Gyroscopic bank and pitch indicator.
(iii) Gyroscopic direction indicator.
(iv) Two sensitive altimeters.
(v) Clock with centre seconds' hand.
(vi) Pitot head protected against icing.
(vii) Gyroscopic instruments power supply indicator.
(viii) Climb and descent indicator.
(ix) Outside air temperature thermometer.
(x) Two air speed indicators (where all up weight exceeds 10,000 lb.).
(xi) Approach chart for each aerodrome on flight plan.

PUBLIC TRANSPORT FLYING MACHINES.

1 *For all flights :—*

(i) Safety harness for every pilot's seat. (Safety belt where aircraft prototype was certified prior to 1st April, 1949.)
(ii) Means of indicating to passengers when safety belts or harnesses should be fastened.
(iii) Gyroscopic rate-of-turn indicator or gyroscopic direction indicator.
(iv) Gyroscopic bank indicator or lateral acceleration indicator.
(v) Sensitive altimeter.
(vi) Clock with centre seconds' hand.
(vii) Other instruments and equipment as may be required in particular circumstances.

2 (a) *For all flights which involve manoeuvres on water :—*

(i) Lifebelt equipped with light and whistle for each person on board.
(ii) Notice in each passenger compartment indicating stowage of lifebelt and method of use.
(iii) Additional flotation equipment of not less than 20 per cent of the capacity of the equipment required under 2(a)(i) must be provided in a stowage accessible from outside the aircraft.
(iv) Equipment of marine type for making pyrotechnical distress signals.
(v) Anchor and mooring equipment appropriate to all up weight of aircraft.

2 (b) *Where all up weight exceeds* 5,000 *lb. :—*

(i) Sea anchor.

(ii) Apparatus to facilitate manoeuvring the aircraft under its own engine power on the water (drogues, etc.).

3 *For flights over water beyond gliding distance from any shore :—*

(i) The equipment and notices specified in 2(a)(i) and (ii) above.

(ii) Equipment for making pyrotechnical distress and green light urgency signals.

NOTE : The Air Navigation Regulations prescribe that a public transport aeroplane must be able to climb at a height of 5,000 ft. with one engine inoperative before it is permitted to carry out a flight over water, in the course of which it may, at any time, be more than 30 minutes flying distance in still air from the nearest shore. There is, however, a proviso to this Regulation to the effect that an aeroplane which fails to comply with this standard of performance, may, *if it carries the equipment specified in* 4 *below*, carry out a flight which will take it more than 30 minutes flying distance from the shore, provided that, in any event, it does not exceed a distance of more than 90 minutes flying distance from the nearest shore.

4 *For flights over water where the aeroplane will at any time be more than* 90 *minutes from the nearest shore :—*

(i) Suitably approved and equipped dinghies sufficient to accommodate all occupants.

(ii) Approved dinghy radio transmitters in the proportion of one transmitter to every four or portion of four dinghies.

5 *For flights by night :—*

(i) Landing lights. Two single filament lamps or one dual filament lamp with separately energized filaments.

(ii) Cabin lights for all passenger compartments.

(iii) Torch for every crew member.

6 *For flights at a height of* 10,000 *ft. or more :—*

(i) Supply of oxygen together with suitable distributing apparatus. Crew and passenger supply systems should be separate.

(ii) In the case of pressurized aircraft oxygen supply for the crew only should be fitted.

(iii) Instruction notices detailing times and method of use should be carried in each passenger compartment.

7 *For flights on which a licensed flight navigator is carried :—*

(i) Chart table.

(ii) Navigational instruments necessary for the particular flight.

(iii) Adequate facilities for taking astronomical observations including checking the magnetic compass.

8 *For flights when weather reports indicate that icing conditions will be encountered :—*

(i) De-icing equipment for wings, tail and control surfaces.

(ii) De-icing equipment for propellers and pitch-changing mechanisms of V.P. propellers, radio fixed aerials, pilots' windscreens, instruments and equipment.

Fire extinguishers must be carried in accordance with British Civil Airworthiness Requirements.

Duplicate instruments, indicators or gauges must be fitted when the originals fitted in the aircraft are not conveniently visible for the performance of the duty of any crew member.

A.N.O. '49 Article 19

A.N.R. '49 Section X

The minimum operating crew carried on a United Kingdom registered aircraft on all flights must be as laid down in the certificate of airworthiness. Where it is specified that any one member must be carried he must not undertake duties in the aircraft other than those for which he is carried and a separate place of duty must be provided.

Where required by the terms of the certificate of airworthiness or the Regulations, the following crew must be carried :—

(i) Where two or more pilots are carried one must be designated as the senior pilot.

(ii) A public transport aircraft of more than 22,500 lb. all up weight flying in compliance with Instrument Flight Rules when arriving or departing at an aerodrome, must carry as second pilot for the particular purpose of assisting the senior pilot, the holder of a commercial, senior commercial or airline transport pilot's licence including an instrument rating.

(iii) A flight navigator must be carried in public transport aircraft if the flight extends over water for a great circle distance of more than 1,000 nautical miles, or extends without landing, for a great circle distance of more than

1,500 nautical miles. Where a pilot and second pilot are carried, either of whom is the holder of a flight navigator's licence and a commercial, senior commercial or airline transport pilot's licence with rating for the particular type of aircraft, the holder of the navigator's licence may be responsible for the navigation.

(iv) A flight radio operator must be carried in accordance with the Air Navigation (Radio) Regulations, 1949. If the aircraft is to be flown in compliance with Instrument Flight Rules and two-way communication by means of morse is to be carried out, the operator must be a separate member of the crew.

XV

THE WEIGHING AND DETERMINATION OF THE CENTRE OF GRAVITY OF AIRCRAFT

IT has already been stated in this handbook that every aircraft must be weighed before a Certificate of Airworthiness is issued and that an approved form of weight schedule must be compiled. During the period of validity of a Certificate of Airworthiness the Board may require an aircraft to be re-weighed and the weight schedule amended accordingly.

A.N.O. '49 Article 13, 39

A.N.R. '49 Section IV

B.C.A.R.

It is a general rule that an aircraft operating for hire or reward is re-weighed at the time of the renewal of the Certificate of Airworthiness. In special cases re-weighing may be waived, provided the owner or operator keeps a careful record of any weight that has been removed or added since the last time the aircraft was weighed.

It is usually unnecessary for an aircraft operating in the private category to be re-weighed annually, but the Board's surveyor will make a careful check of the aircraft and its equipment in relation to the existing weight schedule before recommending the renewal of its Certificate of Airworthiness.

Two copies of a weight schedule are required, one of which must be handed to the Board's surveyor and the other placed in a prominent position in the aircraft.

A specimen weight schedule which has been compiled to comply with the requirements of the Air Navigation Regulations is as follows :—

WEIGHT SCHEDULE

Aircraft Type : *Nationality and Registration Marks :* G—

Part "A." The undermentioned items are included in the "Weight Empty" figure of 7,587 lb. painted on the outside of the aircraft and recorded in paragraph 25 of the Certificate of Airworthiness.

Sensitive Altimeter
Airspeed Indicator
R.P.M. Indicator
2 Oil Pressure Gauges
2 Oil Temperature Gauges
2 Boost Gauges
2 Flap Indicators
Air Temperature Gauge
Brake Pressure Gauge
Artificial Horizon
Turn and Bank Indicator
P.6 Compass
Vacuum Gauge
Ammeter (Hot wire)
3 Navigation and 2 Landing Lights
Trailing Aerial, Winch and Fairlead
Fixed Aerial and Mast
Aerial c/w Switch
Morse Key
Spare Trailing Aerial and Winch
Windscreen Wipers
2-12V Batteries
2 Generators
D.R. Compass and 1 Repeater
8 Cabin Lights
6 Cockpit Lights
2 Fire Extinguishers
2 Fire Axes
Control Lock
Entrance Ladder
Set Curtains
5 Punkah Louvres
Pilot's Cushion and Safety Belt
Navigator's Seat and Safety Belt
Radio Operator's Seat and Safety Belt
Flight Engineer's Seat and Safety Belt

Part "B." The undermentioned items, at the weights shown against each item, comprise the total weight of 138 lb. of removable equipment, excluding radio apparatus and radio parts, recorded in paragraph 29 of the Certificate of Airworthiness.

4 Passenger Seats and Lap Straps	48 lb.
Carpets	48 „
De-icing Fluid	22 „
Navigation Instruments and Pyrotechnics	20 „

Part "C." The undermentioned items, at the weights shown against each item, comprise the total weight of 219 lb. of removable radio apparatus and radio parts, recorded in paragraph 30 of the Certificate of Airworthiness.

A R 1. 5206	45.1 lb.
A R 1. 5083	81.4 ,,
T R 1464	34.0 ,,
A.1134.A Amplifier	22.7 ,,
R.1598 Receiver	3.0 ,,
R.1599 Receiver	2.8 ,,
Dynamotor for A R 1.5083	30.0 ,,

Part "D." Summary of weights shown for the time being in paragraphs 25 to 32 of the Certificate of Airworthiness.

25. Weight of aircraft empty	7,587 lb.
26. Fuel (tanks full) 140 galls. at 7.2 lb. per gal.	1,008 ,,
27. Oil (tanks full) 14 galls. at 9.0 lb. per gal.	126 ,,
28. Crew at 170 lb. each member	340 ,,
29. Removable equipment (excluding radio apparatus and radio parts)	138 ,,
30. Removable radio apparatus and radio parts	219 ,,
31. Maximum commercial load authorised (with fuel and oil tanks full)	982 ,,
32. Maximum total weight authorised	10,400 ,,

Date : *Signed :* *Chief Engineer*
Signed : *A.R.B.Surveyor*

The weight quoted in Part "A" must include :—

1. The liquid in the system if the aircraft is fitted with liquid-cooled engines, and in addition
2. All accessories, instruments, equipment and apparatus, including radio apparatus and all other parts regarded as fixed and irremovable. These items must be listed in the space provided.

Part "B" must include a list of all accessories, equipment and apparatus (excluding radio apparatus) regarded as removable, together with details of their respective weights.

Part "C" must include a list of all the radio apparatus and radio parts regarded as removable, together with details of their respective weights.

Part "D" is self-explanatory, and is a summary of the weights as shown for the time being in paragraphs 25 to 32 of the Certificate of Airworthiness.

The following densities will normally be used when assessing the weights to be entered in items 26—Fuel, and 27—Oil, of part "D."

Fuel—7.2 lb. per gal. (i.e. specific gravity 0.72).

Oil—9 lb. per gal. (i.e. specific gravity 0.9).

The owner or hirer of an aircraft may, however, when preparing a load sheet, make due allowance when the fuel and oil he is using are of different densities from those mentioned above.

The weight empty, i.e. the weight shown in item 25 of Part "D," and the maximum total weight authorised for the aircraft for the time being, as shown on item 32 of Part "D," must be painted in a prominent position on the rear of the fuselage or hull.

Aircraft with long range tankage may have no commercial load when the tanks are full, or they may have a total weight authorised for the take-off in excess of the total weight authorised for landing. These, however, are special cases, necessitating the use of fuel dumping systems or restrictions.

Determination of the Centre of Gravity of Aircraft.

The longitudinal position of the centre of gravity of all "Prototype" aircraft must be determined before the issue of a Certificate of Airworthiness. Calculation of the vertical centre of gravity is not normally required for civil aircraft.

During the period of validity of a Certificate of Airworthiness the Board may require the position of the centre of gravity to be re-determined, when it has reason to believe that structural alterations or changes in equipment have affected the original position of the centre of gravity.

The centre of gravity is usually determined with the chord line horizontal and the aircraft in the "Weight Empty" condition, as shown in Part "A" of the weight schedule. A record of the calculations must be made on A.R.B. Form 262, which is self-explanatory.

The centre of gravity position is defined as "a certain distance behind the leading edge of the mainplane or leading edge datum," or in other cases from a specified position.

The determination of the position of the centre of gravity at weights in excess of the "Weight Empty" condition as shown in Part "A" of the weight schedule may be calculated by the addition or subtraction of weight and moments about the specified position.

XVI

THE CERTIFICATION OF AIRCRAFT BY LICENSED ENGINEERS

CERTIFICATE OF SAFETY.

THIS certification is made by a licensed engineer who is a competent person licensed by the Minister of Civil Aviation, after examination and recommendation by the Air Registration Board. Engineers signing certificates of safety in respect of aircraft and engines must be the holders of Aircraft Maintenance Engineers' Licences in categories "A" and "C" with endorsements covering the type of aircraft and/or engine. Both the aircraft and engine fitted may be certified by the same engineer if he is the holder of a licence in both the "A" and "C" categories.

A.N.O. '49 Article 15

A.N.R. '49 Section VI

B.C.A.R. Notice to Licensed Aircraft Engineers No. 9

Where the magnetic compass(es) have been adjusted and compensated by the holder of a transport or senior commercial pilot's licence or a flight navigator's licence, the next subsequent certificate of safety may be altered by inserting the words "other than magnetic compasses." Such alteration must be initialled by the engineer who issues the certificate.

In the case of a public transport aircraft the certificate must be issued at periods in accordance with the approved Maintenance Schedule. The certificate, which must be in force before a public transport aircraft may fly, indicates that the aircraft and engines have been satisfactorily maintained and are safe for flight. It comes into force immediately after issue and ceases to be in force :—

(i) at the time when a new certificate is required to be issued by the terms of the Maintenance Schedule ;

(ii) if, before expiry, the aircraft sustains a serious defect, at the time at which such defect occurs.

NOTE :—The expression "serious defect" means a defect which would not, in accordance with ordinary aeronautical practice, be remedied by the pilot or crew.

When a Certificate of Safety ceases to be in force as a result of a serious defect, a licensed aircraft engineer will be in order in issuing a new certificate provided :—

(i) He is satisfied that the defect, and any consequential defects, have been remedied.

(ii) Details of the defect or defects and the action taken to remedy the defect or defects, have been recorded and duly certified.

(iii) He is satisfied, on the basis of the information provided by the operator, that, up to the time of the issue of such certificate, all maintenance and inspection required to be carried out in accordance with the approved Maintenance Schedules for the aircraft, have been so carried out.

In the case of a glider being used for instructional purposes, where the instructor and pupil are members of the same club, no certificate of safety need be issued.

CERTIFICATE OF FITNESS FOR FLIGHT ("SERIES" AIRCRAFT).

It has already been stated on page 19 that in the case of "Series" aircraft produced by an aircraft constructor, it is required that, before flight, a licensed engineer should inspect each aircraft and sign a Certificate of Fitness for Flight.

The certificate referred to is contained in the Civil Aircraft Inspection Record of the aircraft (A.R.B. Form 268) and must be signed by engineers licensed in Categories "A" and "C."

THE CERTIFICATION OF OVERHAULS, REPAIRS, MODIFICATIONS AND REPLACEMENTS.

The regulations require that if the validity of the Certificate of Airworthiness is to be maintained, any overhaul, repair, modification or replacement made to an aircraft to which a Certificate of Airworthiness has been granted, must be certified by an engineer licensed in the appropriate categories or by a firm approved for the purpose by the Board.

The certification is made in the relevant log book and will be signed by a licensed aircraft engineer.

XVII

THE ESSENTIAL DOCUMENTS RELATING TO A UNITED KINGDOM REGISTERED AIRCRAFT

THE regulations require that the following documents must be carried by all United Kingdom registered aircraft :—

When engaged in international navigation or in a flight to or from the Channel Islands :—

(a) Certificate of Registration.
(b) Certificate of Airworthiness (including Flight Manual if applicable).
(c) Licences of operating crew.
(d) Journey Log Book.
(e) Telecommunications Log Book.
(f) Licences for radio apparatus.
(g) Certificate of Safety.
(h) Load Sheet.
(i) Passenger list.
(j) Goods manifest.

When not engaged in international navigation, or on a flight to or from the Channel Islands :—

(i) When flying as a public transport aircraft, (b), (c), (f), (g) and (h) are compulsory. Item (h) need not be compiled for aircraft under 2,500 lb. all up weight.

(ii) When flying as an aerial work aircraft, (b), (c), (e), and (f) are compulsory. Item (d) must be carried on a scheduled flight.

From this it will be seen that a privately owned aircraft need not carry any documents unless engaged on international navigation. The private owner must, however, when requested to do so authoritatively, produce the necessary documents within a reasonable time.

Licences of operating crew, mentioned at (c), include pilots', navigators', flight engineers' and radio operators' licences.

LOG BOOKS.

A.N.O. '49
Article 24

A journey log book must be kept and carried by all aircraft engaged in international flying and must be kept for aircraft in the hire or reward categories whether engaged in international flying or not.

The original journey log book is issued by the Ministry of Civil Aviation on request at the time of issue of the first Certificate of Airworthiness and log book refills may be obtained as required from that source. The journey log book is usually maintained by the pilot of the aircraft and the entries refer to flying times and journeys made. A pocket at the back of the book provides stowage for the Certificate of Airworthiness and Certificate of Registration and other necessary documents.

Airframe, engine and V.P. propeller log books are compulsory for public transport or hire or reward aircraft, and are usually provided in the first place by the constructor of the aircraft, engine or propeller concerned. These log books may also be purchased direct from His Majesty's Stationery Office or through a bookseller.

The constructor's Chief Inspector is responsible for completing the initial entries in these log books and there are pages for rigging details and other informative data in the front of the books.

The books are intended to be a complete history of the airframe or engine or propeller and the entries should be suitably certified. The hours flown by the aircraft and the running time of the engine and V.P. propeller must be recorded so that the times since manufacture and since overhaul can readily be seen; these should not include "ground running" times. The times entered in the log books should be on a "chock-to-chock" basis only.

Details of all overhauls, repairs, modifications and replacements made to the aircraft, its engine or V.P. propellers, if fitted, must be entered in the relevant log book and, in the case of replacements, the approval reference and serial numbers must be quoted.

Each entry must be signed and dated and, when signed by a licensed engineer, his licence number and the categories in which he is licensed must be added.

The airframe, engine and propeller log books should not be carried by the aircraft in flight. Operators must retain old log books for a period of at least two years.

Although, apart from the journey log book, it is not compulsory for private owners of aircraft to maintain log books as mentioned above, they are advised to do so, or to maintain some form of record. In any case, a record of any modification or replacement made to the aircraft must be available to the Board's surveyor at the time of renewal of the Certificate of Airworthiness.

In addition to the above it is a requirement that log books must be kept by every member of the operating crew ; also every aircraft equipped with radio apparatus must carry a telecommunication log book.

XVIII

APPROVAL OF PROPELLERS

WHEN a propeller is fitted to an engine it must be approved by the Board as being suitable for that type of engine when installed in a particular type of aircraft.

B.C.A.R. Notice to Licensed Aircraft Engineers No. 4

For example, a propeller fitted to a single-engined aircraft may not be suitable for a multi-engined aircraft, although the engines may be of the same type.

A list of approved propellers is published from time to time in Notices to Licensed Aircraft Engineers and to Owners of Civil Aircraft.

The fitting of a propeller, to an aircraft having a Certificate of Airworthiness, which has not hitherto been approved, constitutes a "Major" modification and design approval must be obtained in the normal way (see page 25). It is permissible and sometimes convenient to deal with the design approval of a propeller without requiring the applicant to relate his application to a particular aircraft. He may relate it instead to all aircraft of a given type.

If a propeller type has already been approved for use on a particular airframe-engine combination, and an application is made for approval of the same type of propeller on a different airframe-engine combination, then, if the design investigation involved is negligible, this can be dealt with under minor modification procedure.

XIX

THE APPROVAL, INSTALLATION AND CARRIAGE OF RADIO APPARATUS IN AIRCRAFT

A.N.(Radio)R. '49

A.N.O. '49

A.N.R. '49

B.C.A.R.

RADIO apparatus capable of transmitting and receiving morse or spoken messages by radio telegraphy, must be carried in all United Kingdom registered aircraft when carrying out a flight as mentioned hereunder :—

(i) Flight in which the aircraft, in order to comply with the Rules of the Air, is required to communicate by radio with Air Traffic Control.

(ii) In the case of a public transport aircraft, flight over water beyond gliding distance from the nearest shore.

(iii) Flight on a scheduled journey.

Further conditions applicable to all aircraft flying as above are as follows :—

(i) Public transport aircraft, operating over regions where search or rescue would be difficult, and flying over water at a greater distance than 100 nautical miles from the nearest shore, must be fitted with radio apparatus capable of sending and receiving messages after normal landing.

(ii) Public transport aircraft which are unable to maintain continuous communication when flying over water beyond gliding distance from the nearest shore, must have fitted radio apparatus capable of being operated on the international distress frequency.

(iii) Where Instrument Flight Rules are to be complied with, the aircraft must be equipped with radio navigation apparatus.

The apparatus must be of an approved type and the installation must be in accordance with requirements prescribed in Section "R" of British Civil Airworthiness Requirements. Any such approval given will remain in force for a period not exceeding

twelve months. Normally this will be renewable at the time of renewal of the certificate of airworthiness.

Self-contained portable radio sets which are not attached physically nor connected electrically to the aircraft are not affected.

Initial installation of radio apparatus in an aircraft creates a new "aircraft radio station" and the aircraft owner or operator must ensure compliance with the following conditions and requirements :—

(i) The apparatus must have been approved in accordance with British Civil Airworthiness Requirements.

(ii) The installation must have been approved in accordance with British Civil Airworthiness Requirements.

(iii) Modification to the aircraft as a result of the installation of the radio apparatus must comply with British Civil Airworthiness Requirements.

Change of ownership invalidates the station licence and installation approval. The new owner should notify the G.P.O. and Ministry of Civil Aviation.

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FEES

	£	s.	d.	A.N.O. '49 Section IV
Registration of aircraft (in certain circumstances this may be reduced to 5/-)	1	1	0	
Issue of Certificate of Airworthiness for "Prototype" aircraft :—				
When the tare weight does not exceed 500 lb. ..	35	0	0	
750 lb. ..	75	0	0	
1,000 lb. ..	90	0	0	
1,500 lb. ..	105	0	0	
2,000 lb. ..	120	0	0	
3,000 lb. ..	132	0	0	
4,500 lb. ..	150	0	0	
6,000 lb. ..	168	0	0	

	£	s.	d.
When the tare weight does not exceed 8,000 lb. ..	192	0	0
10,000 lb. ..	216	0	0
12,500 lb. ..	240	0	0
For each additional 2,500 lb. ..	20	0	0

Issue of Certificate of Airworthiness for "Series" aircraft :—

(a) When the maximum total weight does not exceed 10,000 lb.	5	0	0
(b) When the maximum total weight exceeds 10,000 lb.			
(i) In respect of the first 10,000 lb.	5	0	0
(ii) In respect of each additional 1,000 lb. or part thereof	1	0	0

Renewal of Certificate of Airworthiness :—

(a) When the maximum total weight authorized as shown on the Certificate of Airworthiness does not exceed 2,000 lb.	7	10	0
(b) When the maximum total weight authorized as shown on the Certificate of Airworthiness exceeds 2,000 lb.	7	10	0
(i) In respect of the first 2,000 lb.	7	10	0
(ii) In respect of each additional 200 lb. or part thereof	1	0	0

Issue of a validation of a Certificate of Airworthiness (including any investigation) .. .. As for issue of a C. of A., subject to certain provisions.

Renewal of validation of a Certificate of Airworthiness .. .. As for renewal of a C. of A.

Approval of an engine (including any investigation).

(a) When the power output does not exceed :—			
(i) 200 B.H.P. or 500 lb. thrust	2	0	0
(ii) 500 B.H.P. or 1,250 lb. thrust	4	0	0

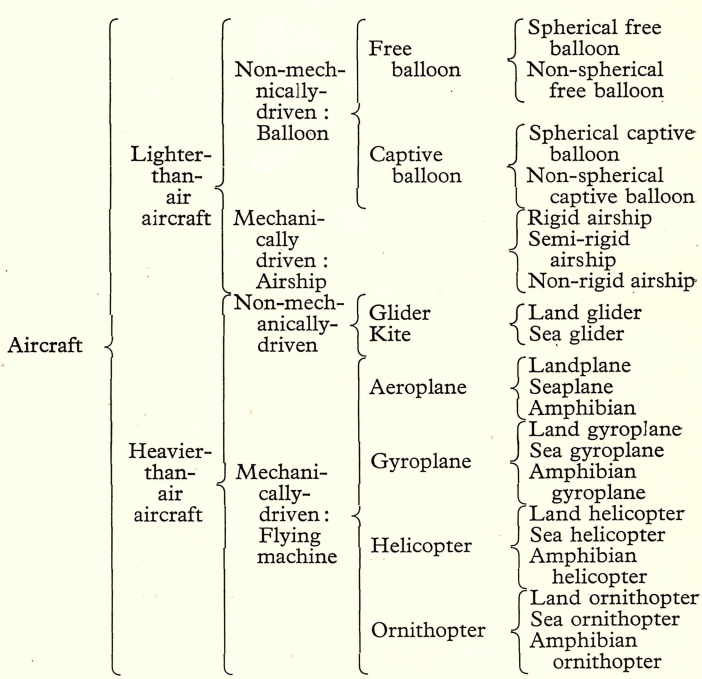
	£	s.	d.
(iii) 1,000 B.H.P. or 2,500 lb. thrust	6	0	0
(iv) 2,000 B.H.P. or 5,000 lb. thrust	8	0	0
(b) When the power output exceeds :—			
(i) 2,000 B.H.P. or 5,000 lb. thrust	12	0	0
Approval of a modification of an aircraft :—			
Percentage not exceeding 100% of the fee chargeable for the issue of a Certificate of Airworthiness.			
Approval of types of instruments and equipment :—			
A fee representing the cost of the work of making the required investigation—Not less than	1	1	0
or more than	100	0	0
Approval of types of radio apparatus and installation :—			
(a) Fee for approval of apparatus and/or subsequent modification representing the cost of the investigation—Not less than	1	1	0
or more than	100	0	0
(b) Fee for approval of the installation of apparatus and/or subsequent modification, representing the cost of the investigation—Not less than ..	1	1	0
or more than ..	100	0	0
(c) Fee for renewal of approval of the installation :			
(i) In aircraft of less than 4,000 lb. maximum all up weight	3	0	0
(ii) In other cases	5	0	0
Fee chargeable for the issue of a Journey Log Book or cover :—			
(i) Complete book (cover and refill)		6	6
(ii) Cover only		3	6
(iii) Refill only		3	0
Replacement of lost certificates, documents and licences :—			
Per copy		5	0

XXI

DEFINITIONS

A.N.O. '49
A.N.D. '49
B.C.A.R.

GENERAL CLASSIFICATION OF AIRCRAFT.



Certificate of Airworthiness. In addition to the certificate this includes any "Flight Manual" or relevant document required to be carried under the law of the country of origin.

Certificate of Safety. A certificate issued in accordance with instructions laid down in Air Navigation Regulations certifying that the aircraft is safe for flight.

Glider. An aircraft which is heavier than air and is not mechanically propelled.

Goods. Includes mails and animals.

Government Surplus. Aircraft and engine parts manufactured solely for use on aircraft of His Majesty's Air Forces and disposed of as being surplus or redundant.

Licence. Certificates of competency issued by the Ministry of Civil Aviation to aircraft engineers, pilots, flight navigators and radio operators.

The Minister. The Minister of Civil Aviation.

The Ministry. The Ministry of Civil Aviation.

Nautical Mile. A distance of 6,080 ft.

Operating Crew. In relation to aircraft this includes pilots, flight navigators, flight engineers and radio operators.

Privilege. A right conferred by a licence entitling the holder to perform any function to which the licence relates.

Personnel. The operating crew of an aircraft and other persons having duties to perform in the aircraft, e.g. stewards.

Public Transport Aircraft.

(a) An aircraft carrying passengers and goods for hire or reward.

(b) Where an aircraft is towing another aircraft, if either is carrying passengers or goods for hire and reward, both must be considered as being public transport aircraft.

(c) Where carriage is undertaken by an air transport undertaking (a) and (b) applies, whether carriage is for hire or reward or not, except where all persons on the aircraft are employed by the undertaking and any goods carried are the sole property of the undertaking.

Radio. A general term applied to the use of electro-magnetic waves of frequencies between 10 k.c. a second and three million m.c. a second.

Radio Apparatus. All apparatus, including any ancillary equipment, for sending or receiving signals by radio.

Rating. An entry in a licence specifying or limiting the effect of a privilege.

United Kingdom. Includes reference to the adjacent territorial waters.

Approved Firm (Inspection Organization). A firm whose inspection department has been approved by the Board to furnish reports in respect of construction, repair and overhaul of aircraft and of materials and parts used for such purposes.

Approved Firm (Design Organization). A firm whose design organization has been approved to furnish reports to the Board that the design of a component complies with the Board's requirements.

V.P. Propeller. A propeller, the pitch of which changes or can be changed, when the propeller is rotating or stationary.

Weight, Maximum all up. The maximum permissable flying weight of an aircraft.

Weight, Empty. The weight of an aircraft complete in flying order, but no crew, fuel, oil, removable equipment or payload.

Air Traffic Control. A service established to promote the safe, orderly and expeditious flow of air traffic.

Instrument Flight Rules. Flight in accordance with the Rules laid down in Air Navigation Order, Section V.

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